Description

Method and data system for connecting a wireless local network to a UMTS terminal station

The present invention relates to a method and a data system for connecting a wireless local network to a UMTS terminal station.

Wireless networks, known as WLANs (Wireless Local Area Networks), are increasingly being installed in small, local areas known as "hot spots" such as, for example, airports, hotels or similar areas with a high subscriber density. Because of the technical possibilities afforded by WLAN it is desirable to use this technology as an add-on to mobile radio systems of the third generation such as, for example, UMTS (Universal Mobile Telecommunications System).

Figure 1 shows the basic principle of a WLAN network architecture in a schematic representation. It depicts a wireless local communication network in which mobile stations MTs (Mobile Terminals) are connected by radio via a plurality of access nodes APs (Access Points) to a broadband data network (BDN). The access nodes APs are WLAN base stations. Each access node AP supplies all the mobile terminals MTs contained in a cell. In this case the cell size can extend to a maximum of several hundred meters. In principle WLANs can be used to build a cellular radio network in which an existing data connection can be handed on from access node to access node in line with the movement of the mobile terminals MT. In mobile radio contexts this is generally known as "roaming". The maximum data rates are dependent on the respective WLAN technology and can range up to 54 Mbit/s.

To connect a WLAN in UMTS, an architecture is known in which WLAN and UMTS represent autonomous systems that are connected

to each other via an interworking unit (IWU). Figure 2 shows this known network architecture in a schematic representation. The purpose of the element IWU is to convert signaling and user data from WLAN to UMTS and vice versa. The WLAN is represented with the elements AP, router and AAAL. The APs are in turn access nodes, the router is a switching processor and the AAAL (Authentication Authorization Accounting Local) is a local computer which is used for authentication, authorization and accounting. The network architecture of UMTS is shown with the elements NodeB, RNC, SGSN, GGSN and HSS. NodeB is a UMTS base station, the RNC (Radio Network Controller) is a radio network control element, SGSN (Serving GPRS Support Node) and GGSN (Gateway GPRS Support Node) are GPRS support nodes and the HSS (Home Subscriber Server) is a local subscriber computer. GPRS (General Packet Radio Service) is a mobile radio standard according to which a dedicated data connection is not set up for each subscriber, but instead the total number of available transmission resources is allocated as needed to the individual subscribers, and the data is transmitted in packets.

In the UMTS the actual terminal station, designated in the diagram as user facility UE (User Equipment), consists of the mobile facility ME (Mobile Equipment) and the physical chip card UICC (Universal Integrated Circuit Card). Figure 3 shows the corresponding layout of a user equipment UE in schematic form. The USIM (Universal Subscriber Identity Module) together with the USAT functionality (USIM Application Toolkit) is implemented as standard on the UICC. The USIM corresponds to the SIM (Subscriber Identity Module) in the second-generation mobile radio standard GSM (Global System for Mobile Communications). The USIM enables a mobile radio subscriber to use his or her ME in a UMTS radio network. All the important data of the subscriber access is stored on the USIM, said data serving to identify and to prove the access authorization, that is to say authentication, of the mobile radio subscriber,

as well as to ensure encryption and decryption of the user data as protection against eavesdropping and tampering or corruption. The USAT functionality enables the ME to be configured directly via the UMTS radio network. Technical specification TS 31.111 Version 4.5.0 (2001-12) "USIM Application Toolkit (USAT)" of the 3rd Generation Partnership Project (3GPP) deals with the interface between the ME and the UICC and essentially comprises a list of commands which the ME can convert interactively with the UICC.

With the desired connection of WLAN in UMTS there is however the problem that frequent connection setups and/or cleardowns are necessary due to the non-permanent availability of the WLAN. Known procedures are handicapped by a high signaling overhead or often cannot guarantee reliable connection setup and/or cleardown. Furthermore, because of the USIM/USAT standardization in UMTS, an existing data connection in the WLAN should be monitored by the USIM/USAT of the UMTS terminal station. However, an implementation of a corresponding means of control is not known to date.

The object of the present invention is therefore to provide a method and a data system for connecting a wireless local network to a UMTS terminal station with USIM/USAT functionality which enables an exchange of WLAN-specific data between a UMTS terminal station and UICC and in addition guarantees reliable connection setup and/or cleardown.

This object is achieved according to the invention by a method for connecting a wireless local network to a UMTS terminal station with USIM/USAT functionality having the features of claim 1 and a data system for connecting a wireless local network to a UMTS terminal station having the features of claim 8. In addition, a terminal station having the features of claim 15 represents an achievement of the object. The

subclaims each define preferred and advantageous embodiments of the present invention.

The inventive method for connecting a wireless local network to a UMTS terminal station with USIM/USAT functionality comprises the following method steps:

- Monitoring of the activity of the local network by the terminal station,
- Transmission of the type and/or the identity number of the local network to the terminal station following successful detection of local network activity,
- Initiation of a logical connection between the local network and the terminal station, and
- Polling of the specific subscriber data of the local network.

The wireless local network is preferably implemented using WLAN technologies which support broadband radio access to broadband data networks. Furthermore the wireless local network is preferably based on the TCP/IP (Transmission Control Protocol/Internet Protocol), ATM (Asynchronous Transfer Mode), or B-ISDN (Broadband Integrated Services Digital network) standard. Examples of broadband WLAN technologies are IEEE 802.11, Hiperlan/2, Openair or SWAP. In the present context WLAN is used as a synonym for all broadband WLAN technologies.

In a development of the present invention the temporary status of the local network and/or specific subscriber data of the local network is polled at periodic intervals. Corresponding polling cycles are preferably performed during an existing WLAN connection.

In a preferred embodiment the specific subscriber data includes the data: type/identity number, subscriber identification, password, secret key for encrypting and decrypting data, and address of an access node. Furthermore it

is possible that the WLAN-specific data of the subscriber access which is used for identification and authentication of the mobile radio subscriber as well as the encryption and decryption of the user data to protect against eavesdropping and tampering or corruption is stored on the physical chip card UICC of the UMTS terminal station. For example, in order to monitor the connection setup and/or cleardown of an existing data connection in the WLAN the WLAN-specific data of the subscriber access can be requested and stored in the UMTS terminal station by the UICC.

In a development of the present invention the monitoring of the activity of the local network and the transmission of the data to the terminal station is initiated by a universal chip card which is installed in the terminal device. Preferably the universal chip card is the UICC. Furthermore the universal chip card preferably notifies the terminal station of a deactivation of the local network.

In a development of the present invention the universal chip card initiates a cleardown of the logical connection between the local network and the terminal station. Furthermore the terminal station preferably acknowledges all the data transmitted. An acknowledgment of this kind can additionally be used to transmit further information.

The aforementioned object is also achieved by a data system for connecting a wireless local network to a UMTS terminal station. The data system has

- a local network,
- a UMTS terminal station with USIM/USAT functionality which is suitable for establishing a connection to the local network,
- means for monitoring the activity of the local network, said means being contained in the terminal station,

- means for transmitting the type and/or the identity number of the local network to the terminal station, with the transmission taking place following successful detection of local network activity,
- means for initiating a logical connection between the local network and the terminal station, and
- means for polling the specific subscriber data of the local network.

The object of the invention is also achieved by a terminal station, more particularly a mobile radio terminal device, for use in a method according to the invention and/or for use in a data system according to the invention.

The invention will be explained below with reference to the attached drawings and on the basis of exemplary embodiments. The features represented therein and also the features already described above can be essential to the invention not only in the cited combination but also individually or in other combinations. The figures show:

Figure 1 a schematic representation of a WLAN network architecture,

Figure 2 a schematic representation of a UMTS/WLAN network architecture,

Figure 3 a schematic representation of a mobile radio terminal device with a UICC card,

Figure 4 a schematic representation of a UMTS user unit,

Figure 5 an exemplary embodiment of an information flow between UICC and ME.

Figures 1 to 3 have already been explained in the introduction to the description so reference is made to the corresponding embodiments.

Figure 4 shows a schematic representation of a UMTS user unit. The physical chip card UICC (Universal Integrated Circuit Card) includes USIM and USAT. The UICC is connected to the mobile equipment ME via a communication interface C_u. Said mobile equipment ME is connected in turn to a WLAN module WM via the communication interface C_w. In the UMTS unit the hardware-side WLAN connection can be implemented by a corresponding module in a form whereby the module is either already integrated therein as a WLAN radio part or can be inserted as a WLAN PC card into the corresponding interface of the station, for example in the form of a PCMCIA (Personal Computer Memory Card International Association) interface.

Figure 5 shows an exemplary embodiment of an information flow between a physical chip card UICC and a mobile equipment ME. It is assumed in this case that a mobile radio subscriber is at a location at which he or she has access to a UMTS and a WLAN radio network. His or her mobile radio terminal device consists of the components UICC, ME and WM (compare Figures 3 and 4). It is further assumed that a network architecture is present wherein WLAN and UMTS are connected as shown in Figure 2. It is further assumed that the subscriber is registered in the UMTS network with his or her UMTS terminal station and wants to set up an Internet connection by means of a WLAN based on the IEEE 802.11 technology. Toward that end the subscriber must first identify and authenticate himself/herself to the WLAN network. He/she does this by keying his/her name for the purpose of subscriber identification and his/her password for the purpose of authentication into a corresponding input menu of his/her terminal station. This is registered by the WLAN module WM and if the details are input correctly the subscriber can now set up an Internet connection by WLAN.

In order to monitor the connection setup and cleardown and also an existing data connection in the WLAN, the WLAN-

specific subscriber data is requested and stored by the UICC. Figure 5 shows an exemplary embodiment of the corresponding information flow between UICC and ME. It is assumed here that the interface C_W according to Figure 4 is implemented in such a way that it supports the information flow across the interface C_U in a suitable manner.

In step 1 shown in Figure 5 the UICC directs the ME to monitor the "Active" status of the WLAN module WM. As a response 2 thereto the ME sends a positive reception acknowledgement. Following occurrence of the event, that is to say the activation of the WLAN module WM as a result of a connection setup, the ME sends a response 3 containing the set parameters "Status = Active", "WLAN type/identity number = IEEE 802.11" to the UICC. Before the actual polling of the WLAN-specific subscriber data can take place, a logical connection is initiated. This is implemented by the UICC with the request 4 and the set parameter "WLAN type/identity number = IEEE 802.11" to the ME. As the response 5 the ME notifies the UICC by means of the set parameters "Status = OK" and "WLAN type/identity number = IEEE 802.11", as an acknowledgement, that the request has been executed. By means of the request 6 the UICC then interrogates the ME for the subscriber data of the WLAN module. The ME's response 7 contains the corresponding information: WLAN type/identity number, subscriber identification, password, secret key for data encryption and decryption, and Internet protocol address of the access node AP. In the case of the connection cleardown, that is to say the deactivation of the WLAN module, the ME sends a response 8 containing the set parameters "Status = Not Active", WLAN type/identity number = IEEE 802.11" to the UICC. To terminate the logical connection, the UICC sends the command 9 containing the set parameter "WLAN type/identity number = IEEE 802.11" to the ME. Finally, with the response 10 and the status field "OK", the ME notifies the UICC that the

request has been executed and the logical connection terminated.

During an existing WLAN connection, that is to say between the steps 7 and 8, it is also possible that the UICC polls the temporary status of the WLAN module or, as the case may be, the WLAN-specific subscriber data at periodic intervals.

In the exemplary embodiment it was assumed that the interface C_w is already implemented in such a way that it can support the data exchange via the interface C_u (compare Figure 4). Six USAT commands are defined for the purpose of implementing the data exchange between UICC and ME via the interface C_u:

Request the WLAN status: By means of this command the UICC can interrogate the ME for the status, for example "Active" or "Not Active" and type or identity number of the WLAN module, for example IEEE 802.11 or Hiperlan/2. As the response thereto the ME is expected to send the corresponding information to the UICC via the command "terminal response". This command has the parameters status and WLAN type/identity number.

Request WLAN information: By means of this command the UICC can interrogate the ME for the WLAN-specific subscriber data of the WLAN module. As the response thereto the ME is expected to send the corresponding information to the UICC via the command "terminal response". This command comprises the parameters WLAN type/identity number, subscriber identification, password, secret key for data encryption and decryption, and Internet protocol address of the access node AP. This command corresponds to step 6 in Figure 5.

Connect WLAN: By means of this command the UICC can instruct the ME to initiate a logical connection to the WLAN module. As a response thereto the ME is expected to notify the UICC by

means of the command "terminal response" whether the request could be executed or not. This command has the parameter WLAN type/identity number and corresponds to step 4 in Figure 5.

Disconnect WLAN: By means of this command the UICC instructs the ME to terminate a logical connection with the WLAN module. As a response thereto the ME is expected to notify the UICC by means of the command "terminal response" whether the request could be executed or not. This command has the parameter WLAN type/identity number and corresponds to step 9 in Figure 5.

Set up an event list: By means of this command the UICC instructs the ME to monitor the status of the WLAN module, for example "Active". As a direct response thereto the ME is expected to send a "terminal response" containing "Accepted" or "Not accepted" to the UICC as an acknowledgement of the command. If the event occurs, that is to say in the case of the activation of the WLAN module, the ME is expected to send the corresponding information to the UICC by means of the command "terminal response". With this command the WLAN-specific status parameters are added to the already existing parameter list, that is to say, event list. This command corresponds to step 1 in Figure 5.

Terminal response: This is a command by means of which the ME is expected to respond accordingly to the requests of the UICC concerning the above defined WLAN-specific commands. In the process the WLAN-specific parameters, i.e. status, WLAN type/identity number, subscriber identification, password, secret key for data encryption and decryption, and Internet protocol address of the access node AP, are added to the already existing parameter list. This command corresponds to steps 2, 3, 5,7, 8 and 10 in Figure 5.

The following table shows in summary form the list of new commands together with parameter, source and destination:

Command	Parameter	Source	Destination
Request WLAN status	- Status - WLAN type/identity number	UICC	ME
Request WLAN information	- WLAN type/identity number - Subscriber identification - Password - Secret data encryption and decryption key - IP address of the AP	UICC	ME
Connect WLAN	- WLAN type/identity number	UICC	ME
Disconnect WLAN	- WLAN type/identity number	UICC	ME
Set up an event list	- Status	UICC	ME
Terminal response	- Status - WLAN type/identity number - Subscriber identification - Password - Secret data encryption and decryption key - IP address of the AP	ME	UICC